Traveling Science Shows

THE FRANKLIN INSTITUTE

Pre-Show

HOT & COLD

About the Show

What is the coldest thing you can think of? We know how cold snow and ice feel, but in the Hot & Cold show, we will explore something far, far colder than any of us can imagine: liquid nitrogen. At 320°F below zero, this fascinating liquid behaves in surprising ways…and helps us explore states of matter. We will shrink metal, fire a cannon, and shatter a rubber ball while investigating how temperature affects matter.

"Heat makes things expand. That's why days are longer in summer."
- Bil Keane, Family Circus

Matter is made up of tiny moving particles called molecules. In solids, the molecules are packed tightly together and move very little. If we add heat (a form of energy) to a solid, we melt it. As a liquid, the molecules are spread farther apart and can slide past each other. If we then add heat to a liquid, we evaporate it. Gas molecules are far apart and moving freely. Thus, the state of matter relates directly to the amount of energy in the molecules. Changes in temperature also change other properties of matter, such as size, hardness, and shape.

The following activities are designed to preview some of the important concepts about matter which students will encounter during our show. They will also help your students have some fun with science, but please remember to use appropriate safety measures. Adults should always supervise students during experiments.

Thank you for scheduling a Franklin Institute Traveling Science Show.
We are excited to visit you soon!

WHEN HOT IS NOT HOT

FOR GRADES 1-3

How come 55° F during summer feels cold, but 55° F in winter feels warm? Why does liquid nitrogen boil at room temperature? In this activity, students experience a temperature change, and discover that "hot" and "cold" are relative terms. This will help students understand the surprising behavior of liquid nitrogen during our show.

EQUIPMENT

3 bowls
Tape
Marker
Water

PROCEDURE

1. Label one bowl "cold." Label another "warm." Leave the third un-labeled.
2. Fill the bowl marked "cold" with ice water. Fill the bowl marked "warm" with warm water. Fill the un-marked bowl with water at room temperature.
3. Place one hand in the bowl marked "cold" and the other in the bowl marked "warm" for 3 minutes.
4. Place both hands together in the unmarked bowl. Does the water feel warm or cold to your left hand? Your right? Why?
5. Brainstorm things that are hot – would they feel as hot to someone from a tropical place? Brainstorm things that are cold – would they feel cold to someone from the Arctic regions? Discuss why "hot" and "cold" are relative terms; that is, something is only hot or cold compared to something else.

WHY?

When you move your hand from the cold water to the "warmer" (room temp) water, one hand feels warm. As you move your hand from the warm water to the "colder" (room temp) water, that hand feels colder. Although both hands experience the last bowl of water at the same temperature, your brain senses two separate sensations. So the water feels "warm" or "cold" relative to the water your hand was in previously. The greater the difference in temperature, the easier it is to sense a difference.

THE GREAT RACE

FOR GRADES 4-6

On our planet, we find water in three states of matter: solid, liquid, and gas. In our show, we will explain how we can change water and other kinds of matter from one state to another by heating and cooling. In this activity, students compete to melt and evaporate water as quickly as possible.

EQUIPMENT

Ice cubes
Water
Eye droppers
Lamps
Fans

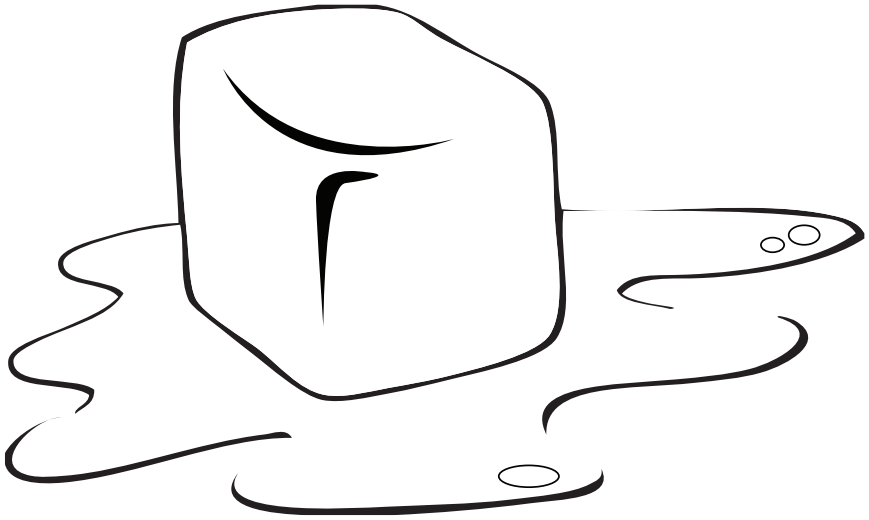
PROCEDURE

1. Give each student one ice cube. Challenge students to melt the cube as fast as possible. What can you do to make it melt faster?

2. After all the ice cubes are melted, use an eye dropper to place three drops of water in front of each student. Ask them to make the water evaporate as quickly as possible. Students might decide to use the fans, lamps, or other classroom materials to promote evaporation.

WHY?

As heat is applied to an ice cube, the molecules of water get more energy. They begin to move more fluidly as the cube melts into a liquid. As heat is applied to liquid water, the molecules again gain more energy and spread apart. The water evaporates into the air as water vapor.



MYSTERY GOO

FOR GRADES 1-6

In this activity, students will create a new material with properties of both a liquid and a solid. This substance challenges students' ideas about classifying matter, and prepares students for the in-depth discussion of matter during the show. This activity can get messy, so you may want to cover the table with newspaper before beginning.

EQUIPMENT

Cornstarch
Water
Large bowl
Large spoon
Cake pan

PROCEDURE

1. Give students small samples of cornstarch and water. Ask them to list their observations of the properties of each. Decide if each sample is a solid, liquid, or gas.

2. Mix about 2 parts cornstarch to 1 part water in the bowl until you have a uniform, gooey consistency. If the mixture is grainy, add more water. If the mixture splashes, add more cornstarch.

3. Pour the mixture into the cake pan. Smack the mixture with your hand and observe the reaction. Now scoop up the mixture and try to hold it in your hand. What happens?

4. Ask students to observe the mixture and describe its properties. How is this mixture like a solid? How is it like a liquid?

5. Encourage students to develop their own experiments. For example, will the mixture flow down a ramp? Will it dry out in the sun?

6. To dispose of the mixture, throw it away in a trash can. Do NOT rinse it down a drain.

WHY?

This mixture acts like a liquid under normal conditions; however, when pressure is applied, it behaves more like a solid. (In fact, a person can actually run across a pool filled with this mixture!) The mixture is classified as a non-Newtonian fluid because it becomes less viscous, or less resistant to flow, under pressure. Blood, latex paint, and syrup are other examples of non-Newtonian fluids that change viscosity under pressure.